5 AIR EMISSIONS SOURCE

CHAPTER CONTENTS

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AMBIENT AIR QUALITY

DQO START DATE	January 1, 2003
REVISION NUMBER/DATE	Rev. 5, November 7, 2007
IMPLEMENTATION DATE	January 1, 2008
POINT OF CONTACT	Jeffrey Williams (631) 344-5587

SUMMARY OF PROPOSED CHANGES

A follow-up evaluation of the potential impacts of lab hood emissions using the DAR-1 computer-based model showed predicted impacts of chloroform and carbon tetrachloride emissions for the years in question were less than one-half their respective Annual Guideline Concentrations (AGCs). Evaluations of lab hood emission impacts for calendar years 2004 through 2006, based on an examination of Chemical Management System hazardous air pollutant consumption records, showed that estimated impacts of chloroform, carbon tetrachloride, and all other hazardous air pollutant compounds in use were less than one half of their respective AGCs. An annual evaluation of emissions impacts will be performed for CY2008.

DESCRIPTION AND TECHNICAL BASIS

Airborne emissions are routinely generated as a result of BNL's operations and research activities. These emissions are released to the atmosphere through a dedicated exhaust system designed to protect workers and building occupants from inhalation exposure to irritants or potentially toxic compounds, or via a building's general ventilation system, when emissions from an operation do not present potential health impacts to workers. Airborne emissions may be released as particles, fumes, or gases.

The EPA has previously delegated authority to NYSDEC to issue permits in accordance with Part 201 of Title 6 of the New York State Code of Rules and Regulations for the construction or modification of any stationary source subject to the federal requirements of prevention of significant deterioration (PSD), and for many sources subject to New Source Performance Standards (NSPS) or NESHAPS. These permits are issued only after NYSDEC is assured from information provided with permit applications, that the operation or activity will be operated in compliance with all applicable regulatory requirements and emissions from new or modified sources and will not adversely impact the ambient air quality or place members of the public at undue risk of inhalation exposure from pollutants of varying levels of toxicity.

The final condition of the Title V Facility permit issued to BNL in January 2002 states that "No person shall cause or allow emissions of air contaminants to the outdoor atmosphere of such quantity, characteristic, or duration which are injurious to human, plant, or animal life or to property, or which unreasonably interfere with the comfortable enjoyment of life or property. Notwithstanding, the existence of specific air quality standards or emissions limits, this prohibition applies, but is not limited to, any particulate, fume, gas, mist, odor, smoke, vapor, pollen, toxic, or deleterious emission, either alone or in combination with others." This condition and regulatory requirement (6 NYCRR 211.2) is a facility-wide condition that applies not only to operations and activities that release emissions to the atmosphere and are authorized under the

Title V Facility permit issued by NYSDEC, but also to operations and activities that are exempt from New York State permitting requirements.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

__x__ Compliance
_____ Support compliance
_____ Surveillance
_____ Restoration

The CCA Clean Air Act Amendments of 1990 establish a national permitting program for facilities that are considered to be major sources of criteria and/or hazardous air pollutants, specify emissions standards and monitoring requirements applicable to various industrial source categories that are significant contributors of criteria pollutants, establish emissions standards applicable to industrial categories which are significant contributors of 189 identified hazardous air pollutants, and seek to maintain and improve air quality throughout the nation. Many of the statutory requirements of the CAA and the 1990 Amendments aimed at maintaining or improving air quality were promulgated into regulations administered by NYSDEC under Parts 200 – 257 of the New York State Code of Rules and Regulations.

In their evaluations of new applications for permits to operate emissions sources, NYSDEC uses a guidance document called the DAR-1, Guidelines for the Control of Toxic Ambient Air Contaminants, to evaluate the potential impact to the public of pollutants released into the atmosphere from a process and to determine whether existing or proposed pollution control devices and administrative controls for the process are sufficient to protect the public from adverse impacts from the source's emissions. Using these guidelines, emissions source-specific information (such as exhaust system stack height and diameter, stack exit velocity, and building height) and source-specific potential and actual emissions information are plugged into a conservative dispersion screening model developed by the NYSDEC Division of Air Resources. The model calculates average ambient annual and average short-term concentrations of a compound that would be expected at receptors downwind of the emissions source for the meteorological conditions built into the model. These concentrations are then compared to AGCs and short-term guideline concentrations (SGCs) that have been established by NYSDOH based on available toxicology data on the health risks to humans for that compound. To demonstrate compliance with the aforementioned Title V Facility permit condition, the potential impacts for all proposed emissions sources at BNL that have the potential to release toxic compounds are evaluated using the DAR-1 model.

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

Laboratory operations that release emissions have the potential to impact ambient air quality, the environment, and members of the public if the emissions are not properly controlled at the point where they are generated. Facility-wide procedures are in place requiring owners or operators of new emissions sources to assemble qualitative and quantitative information about potential emissions from the source, along with information about the exhaust system and emissions control devices. This information must be reviewed to determine whether adequate engineering and administrative controls are in place to ensure that the environment and members of the public are not adversely impacted by potential emissions from the source.

Step 2: Identify the Decision

The desired decisions for the review of BNL operations with potential emissions of toxic compounds are:

- Have all potential sources of toxic compound emissions been identified and their potential impacts evaluated?
- Do the DAR-1 assessed impacts of a source's potential emissions show maximum potential concentrations of toxic compounds at downwind receptor locations to be less than corresponding AGCs?

Step 3: Identify Inputs to the Decision

Inputs necessary to support the decisions in Step 2 include:

- Completed Emissions Source Inventory or Emissions Source Modification forms with supporting information on compounds released (i.e., estimated quantities, MSDS, etc.)
- Exhaust system parameters including stack height, building height, exit velocity, and stack exit temperature
- Pollutant emissions rates
- EPA AP-42 emissions factors
- Meteorological data
- Pollution control device efficiencies
- AGC and SGC limits/emissions limits
- NYSDEC DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants
- Chemical Management System queries and reports on chemical use

Step 4: Define the Study Boundaries

To calculate worst-case impacts to compare with AGC and SGC limits, the DAR-1 model requires estimates of maximum hourly emissions rates (lbs/hr) and maximum annual emissions rates (lbs/yr) for all source pollutants. These estimates are based on information from completed Emissions Source Inventory forms or Emissions Source Modification Forms provided by BNL personnel. The estimates can be based on material balance calculations, published emissions factors, emissions test results, emissions tests from geometrically similar emissions sources, equipment manufacturer guarantees, and best engineering judgment. Due to atmospheric dispersion of the pollutants, the model may show that maximum impacts may occur beyond the Laboratory boundaries.

Step 5: Develop the Decision Rules

Decision 1

Have all potential sources of toxic compound emissions been identified and potential impacts of emissions evaluated?

The SBMS Subject, Area Non-Radioactive Airborne Emissions, requires line personnel who are responsible for operations that generate nonradioactive emissions to complete and submit forms for new emissions sources or existing sources that are being modified to EWMSD. These forms are reviewed to determine if new or modified sources are subject to New York State permit or other regulatory requirements. All new or modified emissions sources that emit toxic air contaminants are assessed using DAR-1, Guidelines for the Control of Toxic Ambient Air Contaminants, to ensure that the sources are equipped with the appropriate emissions control equipment and will not have an adverse impact on potential on- or off-site receptors. The SBMS Process Assessment subject area also provides an opportunityfor identifying potential sources of toxic emissions.

If there are potential sources of toxic compound emissions that have not been identified and evaluated for their potential impacts to the public and the environment, **then** periodic assessments of conformance to the Nonradiological Airborne Emissions subject area can be a means to identify additional sources for evaluation. Decisions should then be made as to whether the identified sources are subject to permitting requirements, and DAR-1 assessments of the potential impacts of the sources' emissions to members of the public and the environment be conducted.

Decision 2

Do the DAR-1 assessed impacts of a source's potential emissions show maximum potential concentrations of toxic compounds at downwind receptor locations to be less than corresponding AGCs?

If the calculated downwind receptor concentrations of the compounds emitted from a source are less than the respective AGCs and SGCs, **then** no additional control devices are suggested and the impacts from potential impacts of the source emissions are considered acceptable.

If the more refined NYSDEC model shows calculated downwind receptor concentrations of one or more compounds to be above corresponding AGCs or SGCs, **then** administrative controls, such as the substitution of an environmentally benign product or the addition of pollution control devices, will be explored with the operator of the emissions source.

If administrative controls are implemented or pollution control devices are added to reduce emissions, **then** the potential impacts will be evaluated using the DAR-1 screening method or the less conservative computer model based on reduced emissions rates.

If the assessed impacts from an existing source's emissions are greater than one half the respective AGC or SGC for any highly toxic or moderately toxic compound based on the DAR-1 screening method and estimated emissions rates are in doubt, **then** EWMSD may request that representative stack samples be collected to verify emissions rates.

Step 6: Specify Acceptable Error Tolerances

To estimate worst-case toxic emissions rates from the source, instructions with the Emissions Source Inventory and the Emissions Source Modification forms direct users to provide information on the maximum number of hours per day and days per year the emissions source will be used. Similarly, the Cavity Impact Method and the Standard Point Source Method equations used in the DAR-1 dispersion screening model were formulated to calculate worst-case impacts under building downwash conditions. As a result, the screening method calculates conservative impacts under all conditions and will likely overestimate both the short-term and annual impacts, when compared to the results derived from the DAR-1 software program.

The NYSDEC Division of Air Resources tries to base every ambient guideline concentration on its own chemical-specific evaluations. However, due to the number of chemicals manufactured and used in the State of New York, NYSDEC does not have sufficient funds to conduct an evaluation for each chemical. In the absence of self-conducted evaluations, NYSDEC uses other qualitative and quantitative information sources to derive AGCs and SGCs, based on the following hierarchy:

1) Toxicological assessments conducted by NYSDEC
2) Toxicological assessments conducted by NYSDOH
3) Information from the EPA-Integrated Risk Information System (IRIS)
4) Information from EPA Health Assessment Documents
5) Information from the National Toxicology Program
6) Data from ACGIH-TLVs and NIOSH-RELs (whichever is more restrictive)

Interim AGCs can be calculated by applying uncertainty factors (as noted in the equations below) to the most restrictive recognized occupational exposure limits (time-weighted average threshold limit value, TWA-TLV, or the time-weighted average recommended exposure limit, TWA-REL). Interim ACGs are not calculated for high toxicity contaminants such as known or potential human carcinogens.

MODERATE TOXICITY CONTAMINANTS

$$\text{Interim AGC} = \frac{\text{Occupational Exposure Limit}}{420}$$

LOW TOXICITY CONTAMINANTS

$$\text{Interim AGC} = \frac{\text{Occupational Exposure Limit}}{42}$$

Step 7: Optimize the Design

With respect to existing laboratory hoods at BNL, a prior evaluation of the potential emissions from this large group of sources revealed an information gap. Estimates provided in Annual Emissions Statements for calendar years 1997, 1999, and 2001 suggested that the predicted impacts of chloroform emissions would have exceeded one-half the AGC in each of these years and the predicted impact of estimated carbon tetrachloride emissions in 2002 would have exceeded one-half its AGC. A follow-up evaluation of the potential impacts of lab hood emissions using the DAR-1 computer-based model showed predicted impacts of chloroform and carbon tetrachloride emissions for the years in question were less than one-half their respective AGCs. Subsequent evaluations of lab hood emission impacts for calendar years 2004 through 2006, based on an examination of Chemical Management System hazardous air pollutant consumption records, showed that estimated impacts of chloroform, carbon tetrachloride, and all other hazardous air pollutant compounds in use, were less than one-half of their respective AGCs.

ANNUAL COST IMPACT DUE TO PROPOSED CHANGE

There is no associated cost for this DQO.

See Appendix B for the monitoring program for this DQO.

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CENTRAL STEAM FACILITY EMISSIONS

DQO START DATE	January 1, 2003
REVISION NUMBER/DATE	Rev. 4, November 7, 2007
IMPLEMENTATION DATE	January 1, 2008
POINT OF CONTACT	Jeffrey Williams (631) 344-5587

SUMMARY OF PROPOSED CHANGES

On February 19, 2007, the Boiler 6 continuous opacity monitor recorded five opacity exceedances during soot blowing operations. The exceedances occurred during the first soot blowing cycle after an extended two-month long idle period where only nominal volumes of residual fuel were burned to keep the boiler warm. To prevent a reoccurrence, CSF stationary engineers will conduct intermittent soot blowing during extended boiler idle periods.

DESCRIPTION AND TECHNICAL BASIS

Airborne emissions are routinely generated as a result of BNL operations and research activities. These emissions are released to the atmosphere through a dedicated exhaust system designed to protect workers and building occupants from inhalation exposure to irritants or potentially toxic compounds, or via a building's general ventilation system when emissions from an operation do not present potential health impacts to workers. Airborne emissions may be released as particles, fumes, or gases.

Emissions released to the atmosphere from many operations and activities at the Laboratory were authorized via individual permits issued by NYSDEC. These permits were issued only after NYSDEC was assured from information provided in permit applications submitted by BNL that the operation or activity would be operated in compliance with all applicable regulatory requirements and that emissions from new sources would not adversely impact the ambient air quality or place members of the public at undue risk of inhalation exposure from pollutants of varying levels of toxicity.

Various state and federal regulations governing nonradiological releases require facilities to conduct periodic or continuous emissions monitoring in order to demonstrate compliance with emissions limits. BNL has several sources subject to state and/or federal regulatory requirements that do not require emissions monitoring. These emissions sources are included in the Title V Facility permit issued by NYSDEC to BNL on January 11, 2002. Conditions within the permit or the applicable requirements themselves require BNL to demonstrate compliance with federal and state requirements by means other than emissions monitoring. The CSF is the only BNL Title V permitted source that is required to monitor nonradiological emissions.

The CSF supplies steam for heating and cooling to BNL major facilities through an underground steam distribution and condensate grid. The combustion units at the CSF are designated as Boiler Nos. 1A, 5, 6, and 7. Boiler 1A, which was installed in 1962, has a heat input of 56.7 MMBtu/hr.

Boiler 5 was installed in 1965 and has a heat input of 225 MMBtu/hr. The newest units, Boilers No. 6 and 7, were installed in 1984 and 1996, respectively. Each of these boilers has a heat input of 147 MMBtu/hr.

Because of their design, heat inputs, and dates of installation, Boiler Nos. 6 and 7 are subject to Title 6 of NYCRR Part 227-2 and the federal New Source Performance Standard, 40 CFR 60 Subpart Db. As such, these boilers are equipped with continuous emissions monitors for nitrogen oxides (NO_x). Boiler No. 7 is also subject to the 40 CFR 60 Subpart D emissions Standard for total suspended particulates. Initial compliance with the total suspended particulate standard was demonstrated during a boiler performance test completed in December 1997. Flue gases released from the Boiler 7 stack are also continuously monitored for opacity. To measure combustion efficiency, both boilers are also monitored for carbon dioxide (CO_2). To enhance the laboratory's ability to monitor particulate emissions from Boiler No. 6, a continuous opacity monitor was brought on line in 2004. Continuous emissions monitoring results from the two boilers are reported on a quarterly basis to EPA and NYSDEC.

Due to their age, Boilers 1A and 5 are only subject to Title 6 of NYCRR Part 227-2. Initial compliance with the 0.30 lbs/MMBtu NO_x emissions standard of Part 227-2 was demonstrated during a stack test conducted in January 1995 while the boiler burned No. 6 oil with a fuel nitrogen content of less than 0.3 percent and a fuel sulfur content of less than 0.3 percent. Continued compliance with the emissions standard is presumed as long as laboratory analysis of composite residual fuel samples confirms the fuel nitrogen content does not exceed 0.3 percent by weight. Per condition 46.2 of the Title V Facility permit, a stack test must be conducted once during the five-year term of the permit to confirm that Boilers 1A and 5 are meeting the NO_x emissions standard while firing residual fuel and natural gas.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

__x__ Compliance
_____ Support compliance
_____ Surveillance
_____ Restoration

CAA and CAA Amendments of 1990 establish a national permitting program for facilities that are considered to be significant contributors of the 189 identified hazardous air pollutants. The permitting program seeks to maintain and improve air quality throughout the nation by specifying emissions standards and the monitoring requirements that apply to various industrial sources. Many of the statutory requirements of the CAA and the 1990 Amendments for maintaining or improving air quality were promulgated into regulations administered by NYSDEC under Parts 200 – 257 of the New York State Code of Rules and Regulations.

Federal and state regulations 40 CFR 60 Subpart Db and 6 NYCRR 227-2 establish emissions standards for NO_x for all four CSF boilers, and continuous emissions monitoring requirements for NO_x covering Boilers 6 and 7. Conditions of the Title V Facility permit require quarterly reports to demonstrate ongoing compliance with the emissions standards. A condition of the permit specific to Boilers 1A and 5 requires that stack tests be conducted once during the five-year term of the permit to confirm that the NO_x emissions standard is being met while burning both residual fuel and natural gas. Another permit condition requires BNL to conduct a stack test of Boiler 7 once during the five-year term of the permit to confirm that the total suspended particulate emissions standard is being met while burning residual fuel. November 2002 revisions to BNL's permit added conditions requiring BNL to conduct stack tests of Boilers 1A, 5, and 6 once during the five-year term of the permit to confirm that total suspended particulate emissions do not exceed 0.1 pounds per million BTUs of residual fuel burned in the boilers. In addition, DOE Order 450.1 (2003) requires that DOE sites comply with federal and state statutes and regulations.

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

CSF boilers subject to regulatory emissions and opacity standards rely on continuous emissions monitoring systems, intermittent emissions tests, periodic opacity observations, or sampling and analysis of materials used by the operation. Procedures have been established for operating and maintaining the boilers’ continuous emissions monitoring systems (CEMS), and for CSF stationary engineers to make and log daily observations of stack opacity from Boilers 1A, and 5. These procedures are designed to ensure:

- Compliance with regulatory permit monitoring and reporting requirements
- Collection and analysis of samples are performed according to EPA, state, and regulatory agency standards or guidelines
- Compliance with NYSDEC QA and QC requirements for continuous emissions monitoring systems

Step 2: Identify the Decision

The desired decisions for the CSF boilers compliance and monitoring program can be cast as questions.

- Have we collected sufficient monitoring data during periods of boiler operation to meet minimum regulatory and permit data acquisition requirements?
- Are we in compliance with emissions and opacity standards and Title V Facility permit conditions?

Step 3: Identify Inputs to the Decision

Inputs necessary to support the decisions in Step 2 include:

- CEMS CO_2 and NO_x data for Boilers 6 and 7
- Opacity data for Boilers 6 and 7
- Analytical results of residual fuel analysis
- CSF Control Room log
- CEMS log
- Smoke Monitoring log sheets
- Daily CEMS calibration reports
- Contractor quarterly CEMS cylinder gas audit and opacity calibration error test results

Step 4: Define the Study Boundaries

The study boundaries incorporate the stacks for each of the four CSF boilers and continuous or periodic emissions monitoring equipment used to capture, analyze, and record representative samples for compliance monitoring purposes. NO_x data is recorded at 15-minute intervals and the data is reduced to one-hour block arithmetic averages. At least three data points are needed for a valid one-hour block average NO_x reading. Pursuant to 6 NYCRR Part 227-2.6, CEMS data for

NO_x must demonstrate compliance with the NO_x emissions limits of the Title V permit on a 24-hour heat-weighted arithmetic average basis during the period from May 1 to September 15, and on a 30-day rolling average basis from September 16 to April 30.

The Boiler 6 and 7 opacity monitors record light transmittance across the stack diameters at 10-second intervals and automatically covert the data to percent opacity. Collected opacity data is reduced to six-minute averages that are compared to the opacity standards. Excess opacity is any six-minute average reading greater than 27 percent opacity or two or more six-minute average opacity readings in one hour greater than 20 percent opacity.

Periodic testing of Boilers 1A and 5 for conformance with the Title V Permit emissions limit for NO_x must be conducted once during the five-year term of the permit (January 7, 2002 – January 6, 2007). Periodic tests of Boilers 1A, 5, 6, and 7 to confirm that flue gas emissions meet the Title V permit particulate emissions standard must also be conducted once during the five-year term of the permit. The periodic test of Boiler 1A will consist of three one-hour test runs while the boiler is burning residual fuel oil with a nitrogen content not to exceed 0.34 percent by weight. Separate stack tests of Boiler 5 will be conducted while the boiler is burning natural gas and residual fuel, with each test consisting of three one-hour test runs. The particulate emissions tests of Boilers 1A, 5, 6, and 7 will consist of three one-hour test runs, while residual fuel oil is fired.

Step 5: Develop the Decision Rules

Decision 1

Have we collected sufficient monitoring data during periods of boiler operation to meet minimum regulatory and permit data acquisition requirements?

Calibration drift tests are conducted daily on the Boiler 6 and 7 NO_x and CO_2 CEMS. Whenever the measured drift exceeds twice the allowable drift test limits, the CEMS data logger flags this as a warning and the calibration is adjusted.

If the daily drift reading is greater than twice the drift limit five or more consecutive days or the drift reading is more than four times the drift limit, **then** the data logger flags the hourly NO_x as OC (Out of Control) periods. All successive hourly periods are flagged as OC until corrective actions have been taken and the calibration drift measurements are less than the allowable limits (i.e., either less than two times or four times the allowable limit). OC periods are not counted as valid data. Periods of CEM maintenance, CEM calibration, and periods where erroneous data or system errors occur are all flagged by the CEMS data loggers and are counted as invalid data. Under conditions of the Title V Facility permit and requirements of 40 CFR Subpart Db and 6 NYCRR 227-2, sufficient monitoring data have been collected if there is valid CEMS data for 75 percent of the hours per day for 75 percent of the days of the month and 90 percent of the boiler operating hours in the quarter .

If at the end of the quarter it is determined that sufficient valid monitoring data has not been collected, **then** the data substitution method of 6 NYCRR 227-2.6(3)(vii) will be used. Using this method, the 90th percentile value of all CEMS NO_x data collected over the last 180 boiler operating days will be substituted for the invalid or missing periods.

If NO_x monitoring data is not available during the quarter, **then** the data loggers flag the invalid data (e.g., OC – Out of Control, MD – CEM down for maintenance, ED – erroneous data/system error.). OC periods and ED periods are the most likely source of insufficient data being captured during a quarter. Stationary engineers manning the CSF must record the apparent causes for invalid data and actions taken to restore proper CEMS operations. The CEMS Calibration Reports, the CSF Control Room log, and the CEMS log, are reviewed quarterly to ensure that the causes of the invalid periods were identified and corrective and preventive actions were taken to prevent reoccurrences.

Decision 2

Are we in compliance with emissions and opacity standards and Title V Facility permit conditions?

If monitoring data, sample results, and opacity observations demonstrate compliance with emissions limits, opacity standards, and permit conditions, **then** said compliance status is communicated to regulators through quarterly Air Emissions and Monitoring System Performance Reports.

If opacity observations show an exceedance of an emission or opacity standard and the cause is found to be due to regular soot blowing operations, quarterly calibration error testing of the opacity monitor, or due to boiler start-ups or shutdowns, **then** no further notifications beyond those made in quarterly Air Emissions and Monitoring System Performance Reports are required. If NO_x monitoring data shows an exceedance of an emission standard, the cause of the exceedance and the corrective actions taken to bring emissions under the standard are described in the quarterly report. Exceedances of emissions limits or opacity standards are described both quantitatively in Section 1 of the reports and qualitatively (determined causes of exceedances and the corrective or preventative action taken) in Section 5.

If, however, emissions in excess of emissions standards or deviations from permit conditions are found to be due to unavoidable malfunctions of equipment, **then** notification to regulatory agencies shall be made as soon as possible but no later than 48 hours after the occurrence, and an evaluation of the equipment malfunction will be conducted under the BNL Environmental Response Procedure.

Step 6: Specify Acceptable Error Tolerances

CEMS for NO_x have been used on Boilers 6 and 7 to demonstrate compliance with applicable NO_x emissions standards since these boilers became operational in November 1990 and May 1996, respectively. Initial performance tests of the CEMS for each boiler were conducted using EPA-approved methods, to verify their accuracy and ensure that NO_x emissions standards were being met. For Boiler 7, initial testing included an emissions test to confirm that total suspended particulates were below the 40 CFR Subpart Db limit. To ensure that flue gas opacity limits are not exceeded, a continuous opacity monitor is required on Boiler 7. This monitor also serves as a surrogate monitoring device to ensure ongoing compliance with the total suspended particulates emissions limit. A separate continuous opacity monitor is voluntarily used on Boiler 6.

Because the CEMS are used to continuously demonstrate compliance with NO_x emissions standards and opacity limits, quality assurance is essential to ensure that the CEMS are functioning properly. To satisfy quality assurance requirements of 40 CFR 60 Appendixes B and F that are applicable to CEMS, a quality assurance plan for the CEMS for Boilers 7 was prepared and submitted to NYSDEC in 1994 along with an operating permit application. The quality assurance plan was subsequently amended in the summer of 1999 when a new dedicated CEMS was installed for Boiler 6. Before the installation of the new system, emissions from Boiler No. 6

were monitored by a time-share system that electronically switched between stacks to continuously monitor flue gas concentrations of CO_2 and NO_x in Boilers 6 and 7. The amended plan discusses quality assurance practices that are followed to satisfy the requirements set forth in 40 CFR 60 Appendix B and F. After installation of an opacity monitor for Boiler 6 was completed, a separate quality assurance plan for Boiler 6 CO_2, NO_x, and opacity CEMS was submitted to NYSDEC in June 2004.

The CEMS for NO_x and opacity undergo quality assurance checks on a daily and quarterly basis. Daily calibrations to measure the relative accuracy of the CEMS are called calibration drift (CD) tests. The ESC Data Acquisition System initiates the CD tests each day at 8:00 a.m. For the CO_2 and NO_x monitors, samples from calibration gas cylinders are extracted and analyzed by the CEMS. The CD is the difference between the measured CEMS concentration of the cylinder gas sample and the certified concentration of the gas. For the transmissometer (opacity monitor), a calibrated filter screen is automatically placed in the transmissometer path. A spectrophotometer in the transmissometer measures the amount of light trapped by the filter screen and coverts the value to an equivalent opacity. The CD is the difference between the measured opacity of the filter screen and the calibration value certified by the filter screen manufacturer. The allowable calibration drift test limits for each type of monitor are noted in the table below.

DAILY DRIFT LIMITS			
CEM Pollutant	Allowable Limit	Maintenance Limit	Out of Control Limit
Opacity	± 1%	± 2 %	± 4 %
NO_x	± 12.5 ppm	± 25 ppm	± 50 ppm
CO_2	± 0.5 %	± 1 %	± 2 %

Whenever the measured drift exceeds the maintenance limits for NO_x and CO_2, the CEMS data logger flags this as a warning and the CSF stationary engineers manually adjust the calibrations. If the daily drift reading is greater than the maintenance limit five or more consecutive days or the drift reading is more than the OC limit, the data logger flags the hourly NO_x as OC periods. All successive hourly periods are flagged as OC until corrective actions have been taken and the calibration drift measurements are less than the allowable limits. If the measured drift for either opacity monitor exceeds the maintenance limit of 2 percent opacity, a calibration adjustment is made and the optical surfaces of the monitor exposed to emissions are cleaned. Cleaning of optical surfaces exposed to monitoring is also required if the OC limit is exceeded.

For NO_x and CO_2 monitors, quarterly cylinder gas audits musts be performed during the first, second, and third quarters of the year and a relative accuracy test audit (RATA) of the CEMS is done during the fourth quarter. A quarterly calibration error test must be performed each quarter for the opacity monitor.

Step 7: Optimize the Design

The current monitoring fulfills regulatory and Title V permit requirements for Boilers 1A, 5, 6, and 7. As previously noted, conditions within BNL's Title V permit require the Laboratory to conduct stack tests of Boilers 1A, 5, 6, and 7 once during the five-year term of the permit. The stack tests for Boilers 1A and 5 confirm that NO_x emissions from both boilers continue to meet applicable NO_x emissions standards. Additional stack tests of all four boilers are needed to confirm that the total suspended particulate emissions standard is being met while burning residual fuel. Testing of Boilers 1A, 6, and 7 was completed the week of October 23, 2006. Boiler 5 testing was completed on December 20, 2006. Test results confirmed that Boilers 1A and 5 complied with the NO_x emission standard and that all four boilers complied with the total suspended particulate standard, while burning residual fuel.

During periods of operation, the opacity limitations of 6 NYCRR Part 227-1.3 are applicable to CSF Boilers 1A, 5, and 6. This regulatory requirement restricts opacity from a boiler to not more than 20 percent (i.e., a six-minute average) except for one six-minute period per hour of not more than 27 percent opacity. To demonstrate that Boilers 1A, 5, and 6 comply with the opacity limitations of 6 NYCRR Part 227-1.3 during periods of operation, BNL made a commitment to use the flue gas oxygen monitors on each boiler as a surrogate indicator of opacity levels in its Title V permit application. The flue gas monitor data acquisition systems can only be programmed to record measured concentrations at two-minute, five-minute, ten-minute, hourly, or daily intervals. Significant data acquisition system reprogramming would have been needed to report flue gas oxygen concentrations as six-minute averages, the reporting interval that NYSDEC had preferred.

BNL staff discussed the matter with NYSDEC during an annual inspection of Title V permitted processes conducted on March 11, 2002. In the course of these discussions, NYSDEC suggested an option that would allow BNL to certify compliance with the opacity limitations by making and recording daily observations of stack opacity using a method other than EPA Reference Method 9. The Laboratory has since developed and began using a new opacity monitoring procedure (BNL Plant Engineering Procedure No. O&M-CSF-018), whereby CSF operators objectively observe and record opacity on a daily basis using a 0 – 10 scale with a reading of two (2) being “Economy Haze”, a universally recognized term used by boiler operators that suggests an unacceptable level of opacity.

Because the individual opacity observations under this procedure are but snapshots of visible particulate emissions from each boiler and represent a small fraction of the boiler operating day, periods where excess particulate emissions might exceed 20 percent opacity are likely to go unnoticed. Recognizing the deficiencies in the procedure and the fact that violation of the opacity limits could result in the assessment of civil penalties up to $32,500 per violation per day, BNL requested and funds were approved to purchase and install continuous opacity monitors for each of the boilers. Installation of the Boiler 6 opacity monitor is complete. Calibration drift tests of the unit were successful and data acquisition system integration was finalized. Upon completion of the performance test conducted in accordance with the NYSDEC approved test protocol, the opacity monitor was brought on-line October 1, 2004. BNL has reconsidered its plans to purchase and install continuous opacity monitors for Boilers 1A and 5 and has opted instead continue to use the opacity observation procedure to demonstrate their compliance with 6 NYCRR Part 227-1.3 opacity limits.

TOTAL COST OF THE PROGRAM

Approximately $86K is spent annually for current CSF boiler compliance monitoring. This figure includes $10–$15K for the annual RATA of the NO_x and CO_2 monitors, $7–$8K for residual fuel oil samples analyses to verify the sulfur and nitrogen contents meet permit limits established for the Boilers 6 and 7, purchases of standard gases for daily CEMS calibrations, and a service contract for EMI, Inc. to conduct quarterly cylinder gas audits of NO_x and CO_2 monitors and quarterly opacity calibration error tests of the opacity monitors.

Estimated costs for the additional periodic stack tests of Boilers 1A, 5, 6, and 7 are shown below.

ESTIMATED COSTS FOR CSF MONIITORING			
Compliance and Quality Assurance Monitoring	Frequency	Unit Cost	Total Cost
Stack Tests	7 tests every 5 years[1]	$4,300	$30,000
[1] Periodic stack testing of boilers is required again in 2012.			

CY2007 Cost $86,000
CY2008 Cost $86,000
Difference $0

See Appendix B for the monitoring program for this DQO.

AIR MONITORING AT THE BROOKHAVEN LINAC ISOTOPE PRODUCER

DQO START DATE	January 1, 2003
REVISION NUMBER/DATE	Rev. 0, August 29, 2002
IMPLEMENTATION DATE	January 1, 2003
POINT OF CONTACT	Benny Hooda (631) 344-8107

SUMMARY OF PROPOSED CHANGES

- Install shroud above the shaft to test the effectiveness of the shroud as a sealant in reducing the emissions.
- Characterize potential emissions by monitoring the short-lived gaseous emissions during the test phase of the shroud.
- Implement continuous monitoring until the emissions are properly characterized and an EPA decision is made with regard to administrative controls.

There are no proposed changes for CY2008.

DESCRIPTION AND TECHNICAL BASIS

The BLIP facility uses a beam of protons for irradiating targets to produce short-lived radioisotopes that are used for medical diagnostic procedures and research. The proton beam from the Linac degrades through eight different BLIP targets placed in series. The Linac also accelerates protons into the booster of the AGS. The first target in the series is irradiated with 200 MeV protons, and the last target with 20 MeV protons. The proton beam intensity could reach 145 microamperes, but the average beam intensity usually is 85 microamperes. During the irradiation process, the targets are cooled continuously by recirculating water in an 18-inch diameter shaft, which is enclosed in a 30-foot underground tank. After irradiation the targets are moved to the TPL, Building 801, for processing.

The principle gaseous radionuclides produced during target irradiation are oxygen-15 (122.2 seconds half-life) and carbon-11 (20.38 minutes half-life), due to the activation of cooling water and air. The BLIP facility is monitored on a weekly basis for particulates, tritium emissions, and radioiodines with charcoal cartridges at locations identified as 064-250, 064-350, and 064-150, respectively. The sample collection and analyses are done in accordance with procedure EM-SOP-500, *Air Sampling at Permanent Monitoring Stations*, and 40 CFR 61 Appendix B, Method 114, prescribed by EPA. Emissions of the short-lived gases were measured once a year to show compliance with NESHAPs, but due to increased operation during 2001, the potential dose to the maximally exposed individual exceeded 0.1 mrem, the level at which EPA requires continuous emissions monitoring.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS CHANGE

_x_ Compliance
_x_ Support compliance
_x_ Surveillance
___ Restoration

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

In order for the BLIP facility to be in compliance with the NESHAPs regulations, radiological air emissions should be measured on a continuous basis and characterized properly. The technical problem is the sampling of the activation radionuclides created from the proton beam, which include tritium, beryllium-7, carbon-11, nitrogen-13, oxygen-15, and sodium-22. The potential hazards associated with BLIP are tritium in water vapor form, Be-7 and Na-22 particulates, and C-11, N-13, and O-15 in gaseous form. Tritium sampling is conducted with silica gel and the particulates are collected on the filter paper along with radioiodines on the charcoal cartridge. The most significant gaseous effluents include oxygen-15 with 122.2 seconds half-life, and carbon-11 with 20.38 minutes half-life. These gaseous effluents decay via positron emissions and contribute mostly to the immersion dose in contaminated air, and therefore should be characterized to comply with regulations.

The radioactive gaseous emissions cannot be captured by conventional methods but can be directly measured using a low-resolution gamma spectrometer with an in-line sampling system connected to the air exhaust system. In addition, C-11, N-13, and O-15 spectra have to be stripped to evaluate the potential dose contribution greater than 10 percent from each of these radionuclides.

Step 2: Identify the Decision

The decisions for BLIP monitoring program can be formulated as questions.

- Does the potential radiological dose to members of the public exceed 1 percent of the federal dose limit of 10 mrem per year?
- Is BNL in compliance with ambient air quality regulatory requirements?
- Have risk and dose to the members of the public exceeded any threshold values?
- Are facility emissions control systems effective?
- Which radionuclides, if any, contribute to dose in excess of the “10 percent of the dose” limit?

Step 3: Identify Inputs to the Decision

Conduct sampling and analysis in accordance with 40 CFR 61, Appendix B, and Method 114. The following items need to be characterized before any dose estimates can be made. The inputs necessary for the decision include:

- Beam current, beam energy, and planned operations at BLIP
- Stack effluent flow rates—measured, characterized, and confirmed
- Short-lived gases emissions rate—sampled, analyzed, and quantified
- Population data

- Meteorological data
- Stack height, stack diameter, precipitation, and other variables
- Model dose to maximally exposed individual (MEI) using CAP-88 PC, Version 2.0
- 40 CFR 61, Subpart H (NESHAPs) regulations
- Regulatory requirements (DOE Order 5400.1)
- Analytical methods and detection limits (as described in this document)
- *Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities*: ANSI N13.1 (1999)
- Tritium – EPA Method 906
- Gamma spectroscopy – EPA Method 901

Step 4: Define the Study Boundaries

The study is to characterize BLIP stack emissions based on prescribed NESHAPs regulations and ANSI N13.1-1999 standards by collecting representative samples from an ideal acceptable sampling point in the BLIP stack. Listed below are the bounding conditions for sampling the effluents.

- Expected temperature range at potential sampling points in the stack
- Air effluent flow rates, composition, and particle size
- Proper air effluent mixing and stable extraction point

Step 5: Develop the Decision Rules

If any radionuclide is identified that is not naturally occurring in the environment, **then** evaluate the raw data to confirm the radionuclide and compare the concentration with the derived concentration guide to assure regulatory compliance. Calculate the effective dose and base the decision on the following:

- **If** the effective dose to a maximally exposed individual (MEI) is less than 1 percent of the standard, **then** no action is required.
- **If** the dose is greater than 1 percent of the standard and the facility is not continuously monitored, **then** the facility is noncompliant and the Environmental Event Response Procedure (EC-SOP-400) must be followed.

Step 6: Specify Acceptable Error Tolerances

Factor or Consideration	Record sampling	Control Monitoring
Frequency of Sampling	Continuous	Continuous
Frequency of Measurement	Weekly	Real-time
Overall Accuracy	± 30%	± 40%
Overall Precision	± 30%	± 40%
Sampling Accuracy	± 20%	± 20%
Sampling Precision	± 20%	± 20%
Measurement Accuracy	± 20%	± 35%
Measurement Precision	± 20%	± 35%
System Availability	> 95%	> 95%

Step 7: Optimize the Design

The air-monitoring program shall be optimized based on the surveillance data collected, audits, and air surveillance assessments every calendar year. After collection of air emissions data for a year and proper characterization of the short-lived gases C-11 and O-15, undertake a design review of the sampling. The design basis shall assess the cost–benefit impact and consider the frequency of confirmatory sampling.

ANNUAL COST IMPACT DUE TO PROPOSED CHANGE

The annual cost impact of changes at the BLIP could be significant, as an FTE might be required to log data and monitor and record the emissions. As the following table shows, there are some unknowns at this point in time.

ESTIMATED COSTS OF BLIP MONITORING PROGRAM						
Analysis	Minimum Sample Size (m^3)	Detection limit (µCi /mL)	Samples per Year	Turnaround (calendar days)	Cost per analysis	Total Cost
Gross alpha/beta (Filter)	500-700	1.04E-15	1 x 52	14 days	$ 75.40	$3,921
Gamma	500-700		1 x 52		$127.35	$6,622
Charcoal	500-700		1 x 52		$127.35	$6,622
Tritium	Min 7 ml of tritiated water	4.73E-7	1 x 26		$ 52.00	$1,352
Gamma online 511 keV						Unknown

TOTAL COST OF THE PROGRAM

The total cost for the air monitoring program (without the proposed BLIP changes) is shown below. The lower cost is a result of a reduction in the sampling of charcoal cartridges, and fewer tritium sampling locations.

CY 2002 cost	$144,707
CY 2003 cost	$132,501
Difference	–$12,206

See Appendix B for the monitoring program for this DQO.

AIR MONITORING AT THE TARGET PROCESSING LABORATORY (BLDG. 801)

DQO START DATE January 1, 2003

REVISION NUMBER/DATE Rev. 0, October 10, 2004

IMPLEMENTATION DATE January 1, 2003

POINT OF CONTACT Benny Hooda (631) 344-8107

SUMMARY OF PROPOSED CHANGES

There are no proposed changes for CY2008.

DESCRIPTION AND TECHNICAL BASIS

The TPL, Building 801 (also known as the Hot Laboratory), includes five semi-hot cells, three chemical processing hot cells, and three high-level hot cells for the handling and processing of radioactive materials. Metal targets irradiated at the BLIP facility are transported to the TPL and radiopharmaceuticals are chemically extracted for medical diagnostic use. Airborne radioactive emissions are generated as a result of hood work involving the processing of BLIP targets for the recovery of radioisotopes. Each hot cell is provided with individual exhaust air filters as well as a backup filter preceding discharge to a common duct leading to the HFBR stack. Airborne radionuclides released during the extraction process are drawn through multi-stage HEPA and charcoal filters and then vented to the HFBR stack. The TPL emissions are monitored by a particulate filter system for gross alpha/ beta activity, for analysis of gamma-emitting radionuclides, and by a TEDA-loaded charcoal cartridge for radioiodines. Radionuclides released to the atmosphere from TPL operations have not been significant contributors to the site perimeter dose via the airborne pathway (less than one percent).

DOE facilities that have the potential to deliver a radiation dose to a member of the public of greater than 0.1 mrem/yr must be continuously monitored in accordance with NESHAPs requirements (40 CFR 61, Subpart H). The facilities that fall below NESHAP levels require only periodic, confirmatory monitoring. The sample collection and analyses are done in accordance with procedure EM-SOP-500, *Air Sampling at Permanent Monitoring Stations,* and 40 CFR 61 Appendix B, Method 114, prescribed by EPA.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS CHANGE

__x__ Compliance
__x__ Support compliance
__x__ Surveillance
_____ Restoration

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

- Laboratory operations that have the potential to impact the environment through discharge of radioactive emissions should be monitored in accordance with NESHAPs.
- Verify and record air emissions for the facility.
- Monitor emissions compliance with DOE Order 5400.5.
- Monitor unplanned releases.

Step 2: Identify the Decision

- Is BNL in compliance with ambient air quality regulatory requirements?
- Do risk and dose to the members of the public exceed any threshold values?
- Are facility emissions control systems effective?
- Which radionuclides, if any, contribute to dose in excess of the “10 percent of the dose” limit?

Step 3: Identify Inputs to the Decision

Complete sampling and analysis in accordance with 40 CFR 61, Appendix B, and Method 114. The following items shall be characterized before any dose estimates can be made. The inputs necessary for the decision include:

- Stack effluent flow rates
- Qualitatively quantify emissions rates
- Population data
- Meteorological data, wind data
- Agricultural data
- Radionuclide emissions data
- Stack height, stack diameter, precipitation, and other variables
- Model dose to maximally exposed individual (MEI) using CAP-88 PC, version 2.0
- 40 CFR 61, Subpart H (NESHAPs) regulations.
- Regulatory requirements (DOE Order 5400.1)
- Analytical methods and detection limits
- Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities: ANSI N13.1 (1999)
- Tritium – EPA Method 906
- Gamma spectroscopy – EPA Method 901

Step 4: Define the Study Boundaries

Based on prescribed NESHAPs regulations and ANSI N13.1-1999 standards collect representative effluent and analyze samples from an ideal acceptable sampling point in the HFBR stack duct. The following parameters shall be the bounding conditions for sampling the effluents.

- Expected temperature range at potential sampling points in the stack
- Air effluent flow rates, composition, and particle size
- Proper air effluent mixing and stable extraction point

Step 5: Develop the Decision Rules

If any radionuclide is identified that is not naturally found in the environment, **then** evaluate the raw data to confirm the radionuclide and make comparison with the derived concentration guide to assure regulatory compliance. Calculate effective dose and base the decision on:

If the dose is less than 1 percent of the standard, **then** no action is required. **If** the dose is greater than 1 percent, **then** evaluate emissions control systems and continuously monitor the facility.

If the potential impact category (PIC) indicates that the facility stack has the potential to discharge airborne radionuclides in quantities that could cause radiological doses to the members of the public in excess of 1 percent of 10 mrem, **then** implement continuous sampling with a real-time detector for the stack, and use actual source term data in the CAP88-PC, Version 2 modeling program to calculate dose.

If the limiting factor for the source term is the inventory (quantity of material and its physical form), **then** use the 40 CFR 61, Appendix D method to calculate the source term for input into the CAP88-PC, Version 2 modeling program to calculate dose.

Step 6: Specify Acceptable Error Tolerances

Factor or Consideration	Record Sampling	Control Monitoring
Frequency of Sampling	Continuous	Continuous
Frequency of Measurement	Weekly	Real-time
Overall Accuracy	± 30%	± 40%
Overall Precision	± 30%	± 40%
Sampling Accuracy	± 20%	± 20%
Sampling Precision	± 20%	± 20%
Measurement Accuracy	± 20%	± 35%
Measurement Precision	± 20%	± 35%
System Availability	> 95%	> 95%

The baseline condition (i.e., the null hypothesis [H_o]) was established for the emissions rate.

Step 7: Optimize the Design

The air-monitoring program shall be optimized based on the surveillance data collected, audits, and air surveillance assessments every calendar year.

ANNUAL COST IMPACT DUE TO PROPOSED CHANGE

No change is proposed; thus, there is no associated cost.

TOTAL COST OF THE PROGRAM

The total cost for the air monitoring program is shown below. The lower cost is a result of a reduction in the sampling of charcoal cartridges, and fewer tritium sampling locations.

CY 2002 cost	$144,707
CY 2003 cost	$132,501
Difference	–$12,206

Analysis	Minimum Sample Size (m^3)	Detection Limit (μCi /mL)	No. of Samples Per Year	Turnaround Time (calendar days)	Cost Per Analysis	Total Cost
Gross alpha/ beta (Filter)		1.04E-15	1 x 52	14 days	$75	$3,921
Gamma			1 x 52		$127	$6,622
Charcoal			1 x 52		$127	$6,622

See Appendix B for the monitoring program for this DQO.